

Revisit of the mantle electrical structure beneath the Tristan da Cuna hotspot by using a 3-D inversion based on non-conforming deformed hexahedral mesh

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SUMMARY

The Tristan da Cunha islands are located 450 km east of the Mid-Atlantic Ridge and 60 km north of the Tristan da Cunha transform fault, and fracture zone system in the Atlantic Ocean. The islands are products of intraplate hotspot volcanism. However, several controversies are associated with theories for the origin of the Tristan da Cunha hotspot. Previous magnetotelluric data 3-D inversion results based on finite-difference algorithm couldn't image plume-like vertical structure, unlike many geological and geochemical studies (Baba et al., 2017). In this study, we revisit the electrical structure of the region by inverting combined vertical magnetic transfer functions and the MT responses from seafloor stations around the islands and those newly obtained on the Tristan da Cunha and Nightingale islands. The topographic effect is one of the keys to obtaining a more reliable subsurface structure, and therefore, we use two finite-element-based inversion methods of Usui (2021) and Grayver (2015). For inversion analysis, we compared the topographic responses from these methods and a finite-difference-based forward modeling method (Baba & Seama, 2002; Baba & Chave, 2005) used in the previous study (Baba et al., 2017). The responses for sites with minimum topography effects are almost identical from all the three methods except for some sites where difference is observed in shorter periods. This could be due to the difference in the mesh resolution around the sites. The responses for sites with significant topography effects show a reasonable match for the finite-element methods in longer periods. In contrast a significant difference is observed in responses from all three methods for short periods. The comparison of modeled responses proves the applicability of Usui's inversion scheme to MT data from this region. In the workshop, the inversion results from Usui's inversion method will be presented.

Keywords: Non-conforming deformed hexahedral mesh, Finite-element, Marine magnetotelluric
